STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES
WATER DISTRIBUTION OPERATOR CERTIFICATION PROGRAM

Units and Conversion Factors

1 cubic foot of water weighs 62.3832 lb
1 gallon of water weighs 8.34 lb
1 liter of water weighs 1,000 gm
1 mg/L = 1 part per million (ppm)
1 ug/L = 1 part per billion (ppb)
1 mile = 5,280 feet (ft)
1 yd = 3 feet
1 $yd^3 = 27ft^3$
1 acre (a) = 43,560 square feet (ft^2)
1 acre foot = 325,829 gallons
1 cubic foot (ft^3) = 7.48 gallons (gal)
1 gal = 3.785 liters (L)
1 L = 1,000 milliliters (ml)
1 pound (lb) = 454 grams (gm)
1 lb = 7,000 grains (gr)
1 grain per gallon (gpg) = 17.1 mg/L
1 gm = 1,000 milligrams (mg)
1 gm = 1,000,000 micrograms (ug)

CHLORINATION

Dosage, mg/l = (Demand, mg/l) + (Residual, mg/l)

(Gas) lbs/day = (Vol, MG) x (Dosage, mgl) x (8.34 lbs/gal)

HTH Solid (lbs/day) =

$$\frac{\text{(Vol, MG) x (Dosage, mg/l) x (8.34lbs/gal)}}{\text{(\% Strength)}}$$

Liquid (gal/day) =

$$\frac{\text{(Vol, MG) x (Dosage, mg/l) x (8.34 lbs/gal)}}{\text{(\% Strength) x (Specific Gravity x 8.34)}}$$

PRESSURE

PSI $= \frac{\text{(Head, ft.)}}{2.31 \text{ ft./psi}}$ **PSI** = Head, ft. x 0.433 PSI/ft.

lbs Force = (0.785) (D, ft.)^2 x 144 in^2/ft^2 PSI.

VOLUME

Rectangular Basin = Volume, gal
(Length, ft) x (Width, ft) x (Height, ft) x7.48 gal/cu.ft.

Cylinder , Volume, gal =
(0.785) x (Dia, ft)^2 x (Height, Length, or Depth, in ft.) x 7.48 gal/ft^3

Time, Hrs. = $\frac{\text{Volume, gallons}}{\text{(Pumping Rate, GPM, x 60 Min/Hr)}}$

Supply, Hrs.= $\frac{\text{Storage Volume, Gals}}{\text{(Flow In, GPM – Flow Out, GPM) x 60 min/hr.)}}$

SOLUTIONS

Lbs/Gal $= \frac{\text{(Solution \%)}}{100}$ x 8. 34 lbs/gal x Specific Gravity

Lbs Chemical =
Specific Gravity x 8. 34 lbs/gallons x Solution(gal)

Specific Gravity $= \frac{\text{Chemical Wt. (lbs/gal)}}{\text{8. 34 (lbs/gal)}}$

\% of Chemical in Solution $= \frac{\text{(Dry Chemical, Lbs)} \times 100}{\text{(Dry Wt. Chemical, Lbs) + (Water, Lbs)}}$

GPD $= \frac{\text{(Vol, MG) x (Conc., mg/l) x (8.34 lb/gal)}}{\text{(\% Strength) x Chemical Wt. (lbs/gal)}}$

GPD $= \frac{\text{(Feed, ml/min. x 1,440 min/day)}}{\text{(1,000 ml/L x 3.785 L/Gal)}}$

Two – Normal Equations:

a) $C_1V_1 = C_2V_2$ $\quad \frac{Q_1}{V_1} = \frac{Q_2}{V_2}$

b) $C_1V_1 + C_2V_2 = C_3V_3$

C = Concentration, V = Volume, Q = Flow

PUMPING

1 horsepower (Hp) = 746 watts = 0.746 kw = 3,960 gal/min/ft

Water Hp $= \frac{\text{(GPM) x (Total Head, ft)}}{\text{(3,960 gal/min/ft)}}$

Brake Hp $= \frac{\text{(GPM) x (Total Head, ft)}}{\text{(3,960) x (Pump \% Efficiency)}}$

Motor Hp $= \frac{\text{(GPM) x (Total Head, ft)}}{\text{(3,960) x Pump \% Eff. x Motor \% Eff.}}$

"Wire to Water" Efficiency
= (Motor, % Efficiency x Pump % Efficiency)

Cost, $ =
(Hp) x (0.746 Kw/Hp) x (Operating Hrs.) x cents/Kw-Hr

Flow, velocity, area

Q = A x V Quantity = Area x Velocity

Flow (ft^3/sec) = Area(ft^2) x Velocity (ft/sec)

General

($) Cost / day = Lbs/day x ($) Cost/lb

Removal, Percent $= \frac{\text{(In - Out)} \times 100}{\text{In}}$

Specific Capacity, GPM/ft. $= \frac{\text{Well Yield, GPM}}{\text{Drawdown, ft.}}$

Gals/Day = (Population) x (Gals/Capita/Day)

GPD = $\frac{\text{(Meter Read 2 - Meter Read 1)}}{\text{(Number of Days)}}$

Volume, Gals = GPM x Time, minutes

SCADA = 4 mA to 20 mA analog signal

$$\frac{\text{(live signal mA - 4 mA off set) x process unit and range}}{\text{(16 mA span)}}$$

4 mA = 0 20 mA full -range